

REMARKS

The application has been reviewed in light of the Office Action dated January 25, 2006. Claims 1-16 were pending. By this Amendment, new claims 17-19 have been added, claims 11 and 12 have been canceled, without prejudice, and claims 1, 4, 9, 15 and 16 have been amended to place the claims in better form for examination and to clarify the claimed invention. Accordingly, claims 1-10 and 13-19 are now pending, with claims 1 and 15-17 being in independent form.

Claim 4 was objected to as having informalities.

In response, claim 4 has been amended to clarify the claimed invention.

Withdrawal of the objection to the claims is respectfully requested.

Claims 1, 2, 4 and 8-16 were rejected under 35 U.S.C. § 102(b) as purportedly anticipated by Pruessman et al., MRM, 42:952-962. Claim 3 was rejected under 35 U.S.C. § 103(a) as purportedly obvious over Pruessman in view of U.S. Patent No. 6,242,916 to King. Claim 5 was rejected under 35 U.S.C. § 103(a) as purportedly obvious over Pruessman in view of U.S. Patent No. 4,770,182 to Damadian. Claims 6 and 7 were rejected under 35 U.S.C. § 103(a) as purportedly obvious over Pruessman in view of U.S. Patent No. 6,289,232 to Jakob et al.

Applicant has carefully considered the Examiner's comments and the cited art, and respectfully submits that independent claims 1, 15 and 16 are patentable over the cited art, for at least the following reasons.

This application relates to magnetic resonance imaging apparatus suitable for parallel imaging for rapidly imaging a tissue structure inside an object to be examined using a plurality of receiving coils.

For example, independent claim 1 is directed to magnetic resonance imaging apparatus

including a plurality of receiving coils for receiving a magnetic resonance signal generated from an object to be examined, sensitivity image data acquiring means for acquiring sensitivity image data by executing a first pulse sequence using the plural receiving coils from a plurality of slice positions separated from each other at intervals on the object, means for acquiring examination image data of each of the plural receiving coils from the plural slice positions sequentially adjoining on the object by executing a second pulse sequence using the plural receiving coils while a phase encoding matrix in a k space is thinned out, and artifact removing means for generating sensitivity distribution data of the plural receiving coils on the slice positions of the examination image data on the basis of the plural sensitivity image data and removing an aliasing artifact in the examination image using thus generated sensitivity distribution data of the receiving coils. In addition, an unmeasured sensitivity image of each receiving coil is calculated with a slice interpolation before the sensitivity distribution of each receiving coil is calculated. Each of independent claims 1, 15 and 16 have been amended to clarify these features, in addition to addressing additional features.

Pruessman, as understood by Applicant, is directed to a sensitivity encoding technique based on the premise that receiver sensitivity purportedly has an encoding effect complementary to Fourier preparation by linear field gradients.

As understood by Applicant, Pruessman proposes that the resolution of a reference may be lower than that of a final image, and the full-resolution map is then obtained by standard interpolation, that is, at first the reference is obtained as small-sized matrix image and then is expanded to full-size matrix image by the standard interpolation to prepare the full-resolution sensitivity map. This interpolation is a processing within only one slice image, and not a processing over multiple-slice images.

Applicant does not find disclosure or suggestion in Pruessman, however, that an unmeasured sensitivity image of each receiving coil is calculated with a slice interpolation before the sensitivity distribution of each receiving coil is calculated, as provided by the claimed invention of amended claim 1.

King, as understood by Applicant, is directed to partial Fourier acquisition of MR data over a limited field of view.

As understood by Applicant, King proposes that sensitivity can be measured at a small number of fixed, widely separated planes, and interpolation may be used to estimate the sensitivity at the desired planes. However, such interpolation compromises the accuracy of the sensitivity matrix, and is not for estimating the calibration image but rather is for estimating the sensitivity of an unmeasured slice, which makes lower the accuracy of the estimated sensitivity because the processing order can enhance errors of the estimation. As discussed in King ([0012]), the sensitivity of the surface coil is calculated by dividing the calibration image of the coil by the calibration image of the body coil, and once an error is induced in the calculated sensitivity through the division, the interpolation applied to the inaccurate sensitivity enhances and expands the error in the calculated sensitivity. Therefore, the sensitivity generated by the processing order of King can have enhanced errors and lower accuracy.

The remaining references were cited only against dependent claims of the present application.

Applicant does not find disclosure or suggestion in the cited art that an unmeasured sensitivity image of each receiving coil is calculated with a slice interpolation before the sensitivity distribution of each receiving coil is calculated, as provided by the claimed invention of amended claim 1. The slice interpolation of the claimed invention is for calculating the

sensitivity image, and not (such as proposed by King) for calculating the sensitivity distribution. The approach of the claimed invention makes higher the accuracy of the sensitivity distribution as compared to that of King.

Independent claims 15-17 are patentably distinct from the cited art for at least similar reasons.

Accordingly, for at least the above-stated reasons, Applicant respectfully submits that independent claims 1 and 15-17, and the claims depending therefrom, are patentable over the cited art.

In view of the amendments to the claims and remarks hereinabove, Applicant submits that the application is now in condition for allowance. Accordingly, Applicant earnestly solicits the allowance of the application.

If a petition for an extension of time is required to make this response timely, this paper should be considered to be such a petition. The Patent Office is hereby authorized to charge any fees that may be required in connection with this amendment and to credit any overpayment to our Deposit Account No. 03-3125.

If a telephone interview could advance the prosecution of this application, the Examiner is respectfully requested to call the undersigned attorney.

Respectfully submitted,



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